

WE CLAIM:

1. A leadframe for use with integrated circuit chips comprising:

5           a plated layer of gold selectively covering areas of  
          said leadframe intended for solder attachment;  
and

          said gold layer providing a visual distinction  
          to said areas.

- 10   2. A leadframe for use with integrated circuit chips,  
     having a chip mount pad and a plurality of lead  
     segments, comprising:

          a leadframe base made of copper or copper alloy;  
          a first layer of nickel deposited on said copper or  
15       copper alloy;

          a layer of an alloy of nickel and palladium on said  
          first nickel layer;

          a second layer of nickel on said alloy layer, said  
          second nickel layer deposited to be suitable for  
20       bending of said lead segments, wire bonding, and  
          solder attachment;

          a layer of palladium, said palladium layer deposited  
          to be suitable for protecting the nickel surface  
          for wire bonding and solderability, and for  
25       adhesion to molding compound; and

          a layer of gold selectively covering areas of said  
          lead segments intended for solder attachment,  
said

          layer of gold providing a visual distinction to  
30       said areas and having a thickness to optimize  
          solder attachment.

3. The leadframe according to Claim 2 wherein said gold

layer has a thickness in the range from 2 to 5 nm.

4. The leadframe according to Claim 2 wherein said first nickel layer has a thickness in the range from 50 to

150

5 nm.

5. The leadframe according to Claim 2 wherein said alloy layer has a thickness in the range from 50 to 150 nm.

6. The leadframe according to Claim 2 wherein said second nickel layer has a thickness in the range from 1000 to

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3000 nm.

7. The leadframe according to Claim 2 wherein said palladium layer has a thickness in the range from 25 to 75 nm.

8. The leadframe according to Claim 2 wherein said copper or copper alloy base has a thickness between about 100 and 250  $\mu\text{m}$ .

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9. The leadframe according to Claim 2 wherein said solder attachment comprises solder materials selected from a group consisting of tin/lead, tin/indium, tin/silver, tin/bismuth and conductive adhesive compounds.

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10. The leadframe according to Claim 1 wherein said leadframe comprises an iron-nickel alloy or invar base, selectively plated with gold.

11. A semiconductor device comprising:

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a leadframe comprising a chip mount pad for an integrated circuit chip and a plurality of lead segments having their first end near said mount pad and their second end remote from said mount pad;

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said leadframe having a first surface layer of nickel, a layer of an alloy of nickel and palladium, a second layer of nickel, and a layer

of palladium;  
said leadframe further having an outermost layer of  
gold selectively covering said second ends of  
said

5 lead segments in a thickness suitable to optimize  
solder attachment;

an integrated circuit chip attached to said mount  
pad;

bonding wires interconnecting said chip and said  
10 first ends of said lead segments;  
encapsulation material surrounding said chip,  
bonding

wires and said first ends of said lead segments,  
whereby the adhesion between said encapsulation  
15 material and said surrounded parts is maximized;  
and

said encapsulation material leaving said second ends  
of said lead segments exposed, whereby the solder  
attachment to said gold layer is maximized.

20 12. The device according to Claim 11 wherein said bonding  
wires are selected from a group consisting of gold,  
copper, aluminum and alloys thereof.

13. The device according to Claim 11 wherein the bonding  
wire contacts to said first ends of said lead segments  
25 comprise welds made by ball bonds, stitch bonds, or  
wedge bonds.

14. The device according to Claim 11 wherein said  
encapsulation material is selected from a group  
consisting of epoxy-based molding compounds suitable  
30 for  
adhesion to said leadframe.

15. The device according to Claim 11 further comprising lead

segments having said second ends bent, whereby said segments obtain a form suitable for solder attachment.

5 16. A method for fabricating a leadframe comprising a chip mount pad and a plurality of lead segments having their first end near said mount pad and their second end remote from said mount pad, comprising the steps of:

10 selectively masking said chip pad and said first segment ends, thereby leaving said second segment ends exposed; and

plating a layer of gold on said exposed segment ends in a thickness suitable to optimize solder attachment, thereby creating a visual distinction  
15 between the gold-plated and unplated leadframe areas.

17. A method for fabricating a leadframe comprising the steps of:

20 providing a copper leadframe having a mount pad for an integrated circuit chip and a plurality of lead

segments having their first end near said mount pad and their second end remote from said mount pad;

25 cleaning said leadframe in alkaline soak cleaning and

alkaline electrocleaning;  
activating said leadframe by immersing said leadframe

30 into an acid solution, thereby dissolving any copper oxide;

immersing said leadframe into an electrolytic nickel

plating solution and depositing a first layer of  
nickel onto said copper;  
electroplating a layer comprising an alloy of nickel  
and palladium;  
5 electroplating a second layer of nickel, thereby  
adapting said lead segments for mechanical  
bending;  
electroplating a layer of palladium;  
selectively masking said chip pad and said first  
10 segment ends, thereby leaving said second segment  
ends exposed; and  
plating a layer of gold on said exposed segment ends  
in a thickness suitable to optimize solder  
attachment, thereby creating a visual distinction  
15 between the gold-plated and unplated leadframe  
areas.

18. The method according to Claim 17 wherein said gold  
plating is performed electrolytically or electrolessly.

19. The method according to Claim 17 wherein said masked  
20 parts of said leadframe comprise the leadframe areas to  
be encapsulated by molding compound.

20. The method according to Claim 17 wherein the process  
steps are executed in sequence without time delays, yet  
including intermediate rinsing steps.

25 21. The method according to Claim 17 wherein said acid  
solution may be sulfuric acid, hydrochloric acid or any  
other acid.

22. A method for fabricating a leadframe comprising the  
steps of:

30 providing a copper leadframe having a mount pad for  
an integrated circuit chip and a plurality of  
lead

segments having their first end near said mount pad and their second end remote from said mount pad;

cleaning said leadframe in alkaline soak cleaning

5 and

alkaline electrocleaning;

activating said leadframe by immersing said leadframe

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into an acid solution, thereby dissolving any copper oxide;

electroplating a layer of nickel, thereby adapting

said lead segments for mechanical bending;

electroplating a layer of palladium;

selectively masking said chip pad and said first

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segment ends, thereby leaving said second segment ends exposed; and

plating a layer of gold on said exposed segment ends

in a thickness suitable to optimize solder

attachment, thereby creating a visual distinction

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between the gold-plated and unplated leadframe areas.